Using grammatical features to forecast incoming structure: The processing of Across-the-board extraction

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Background: Across the board (ATB) extraction

- A filler (e.g. wh-phrase) is linked to multiple gaps, each in a different conjunct.
- ATB extraction is degraded when two gaps have different syntactic functions (Williams (1978): LI):

(a) Parallel syntactic functions (good)

The surgeon who James tricked G1 and Richard annoyed G2 scrubbed up for surgery

(b) Non-parallel syntactic functions (bad)

* The surgeon who G1 tricked James and Richard annoyed G2 scrubbed up for surgery.

- Is this contrast due to a grammatical constraint?
  - e.g. (b) is ungrammatical because the operator *who* is not allowed to be linked to nominative and accusative case simultaneously.
- Or is it due to processing differences?
  - Parallelism preference (Frazier et al, 2000, JPR):
  - 2nd conjunct in (b) is hard because its internal structure differs from 1st conjunct

Experiment 1 design

(a) Parallel: ATB

The surgeon who James tricked G1, and Richard annoyed G2, scrubbed up for surgery

(b) Non-Parallel: ATB

The surgeon who G1 tricked James, and Richard annoyed G2, scrubbed up for surgery.

(c) Parallel: Non-ATB

The surgeon who James tricked G1, and who Richard annoyed G2, scrubbed up for surgery

(d) Non-Parallel: Non-ATB

The surgeon who G1 tricked James, and who Richard annoyed G2, scrubbed up for surgery.

- Non-ATB conditions included as a control:
  - Non-ATB conditions include operator for each conjunct
  - If (a) vs. (b) contrast is due to grammatical constraint, there should be no comparable contrast (c) vs. (d), since each *who* is linked to just one gap (so no case clash)
  - However, parallelism effects should be similar whether ATB or not

Experiment 2 design

- Same conditions as Exp1, but with extra embedding
- Each relative clause was 2 clauses deep
- Gap inside the most deeply embedded clause

(a) Parallel: ATB

The surgeon who I think James tricked G1, and you think Richard annoyed G2, scrubbed up for surgery

- Previous work (e.g. Williams (1978), LI) claims that ATB acceptability contrast (a) vs. (b) disappears in embedding contexts

Experimental set-up (both Exp1 and Exp2)

- 40 participants
- Eye-tracking during reading (Eyelink 1000)
- 36 sentences

Critical Region

The surgeon who James tricked and **Richard annoyed** scrubbed up for surgery

Analysis measures

Go-Past time

The time taken to "go past" a region: sum of fixation durations from the first entry into the region from the left, to the first exit to the right

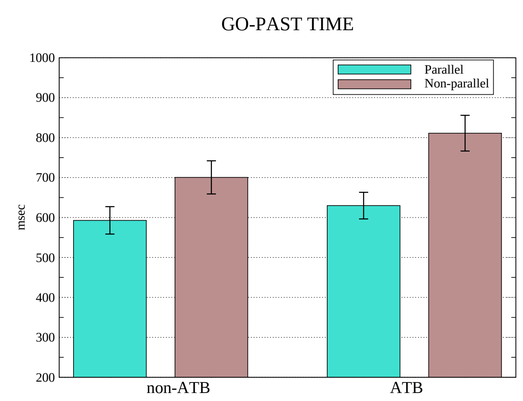
Proportion of First-pass regressions

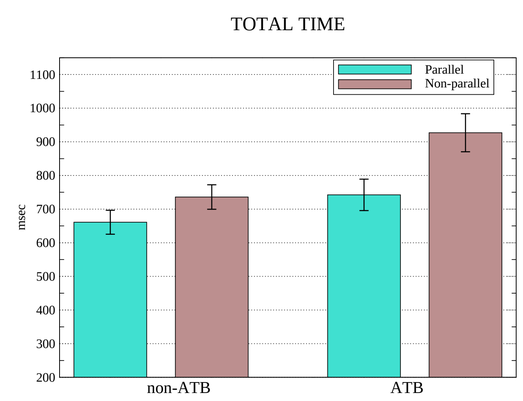
Proportion of trials where the first exit from the region is a regression.

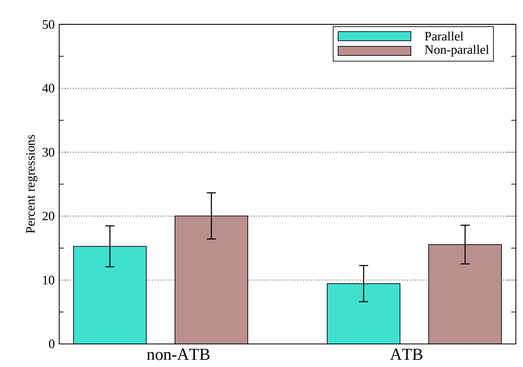
Total Time

Summed durations of all fixations in the region.

Experiment 1: Results (critical region)

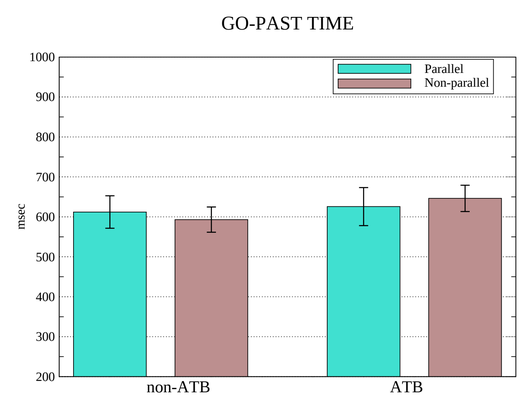


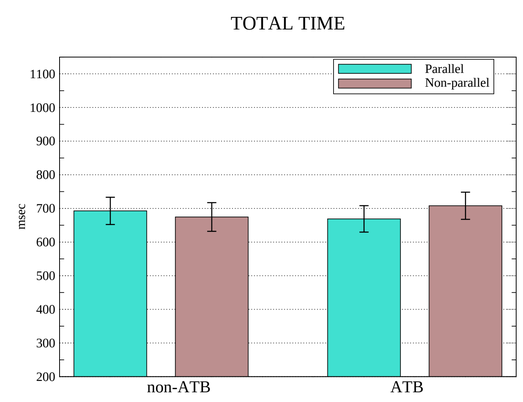


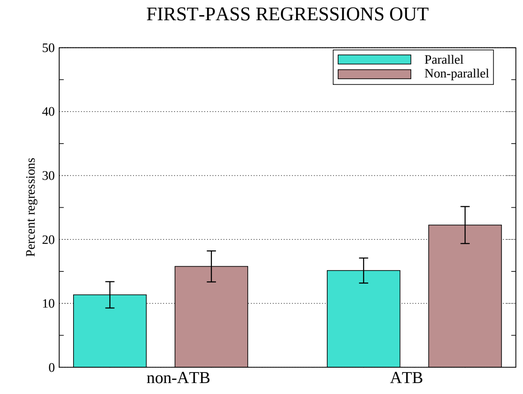


- Main effect of parallelism in all measures (all p's $< .01$): Reading times shorter, and fewer regressions, in Parallel relative to non-parallel
- Interaction of Parallelism $\times$ ATB in Total time (p's $< .05$), and marginal in Go-Past ($p_1 < .06$; $p_2 < .05$):
  - Larger parallelism effect in ATB than in non-ATB

Experiment 2: Results (critical region)







- Parallelism effect in regressions out (fewer regressions for parallel than non-parallel): p's $< .05$
- No parallelism effects or interactions in other measures
- Parallelism effect significantly attenuated in Exp2 compared with Exp3 (Go-past, Total-time; Experiment $\times$ parallelism interaction)

Summary

- Parallelism clearly plays a role in subject vs. object relative clause extraction.
- Some evidence for the grammatical account (extra parallelism effect in Exp1, over and above baseline parallelism effect (leads to interaction)
- However, no evidence of the interaction in Exp2, and Parallelism also significantly reduced.
- If the contrast in (a) vs. (b) is related to passing of case features, then structural distance introduced by embedding may have degraded this process.
- Extra embedding also reduces parallelism